The Sampler

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Frog Malformities Spark Concern

Interview by Stephanie Bowser, VLAP Coordinator, with Hilary Snook, EPA Biologist

On a global scale there has been a decline in frog populations and an increase in frog malformities. In recent months, research has been done to explore the causes and possible solutions.

Photo courtesyof the DES Biomonitorig Program

Stephanie: Are there theories why the frog population is declining?

Hilary: Many theories exist on the causes of declining frog populations. One theory is acid deposition. We are losing frogs in certain regions of the country at higher altitudes where there is a predominance of acid deposition. Deposition gets into snow pack; then when you have a melt, it creates an acid slug that runs off and basically wipes out or severely stresses a lot of the species. Declining populations have not been limited to high altitudes either. Species have been disappearing in tropical regions as well.

It has been proven that there are significant seasonal acidic pulses that have had effects on some of the biota. In the western region of the country it appears to be related to elevation. There have been thoughts that part of it might also be due to increasing exposure to ultra violet light (UV-B) as a result of the deterioration of the ozone layer.

Stephanie: Have you heard of a similar decline in other creatures like turtles?

Hilary: As far as population declines, I haven't. In salamanders and other amphibians they've been finding deformities. Population declines are also likely attributed to less open space and habitat alteration.

Stephanie: We've been hearing a lot about malformed frogs. What is the difference between a malformity and a deformity?

Hilary: A malformed frog is a frog that has certain abnormal morphological characteristics, such as toes or limbs, extra webbing, or an extra eye. It's caused from a developmental abnormality. Deformity is referred to as a missing part of the frog's anatomy, usually as a result of predation.

Stephanie: Have they found any malformed frogs around New England?

Hilary: U.S. Fish a nd Wildlife has in Vermont's Poultney River in the Lake Champlain basin and other areas around New England. In the Poultney River the malformity rate was quite high, like 45%. They found one site in New Hampshire at Lake Umbagog where of 26 frogs collected, 7.6% were abnormal (though sample size was small). *(Editor's Note: See inset on page 5 for an update on the status of malformed frogs in New Hampshire.)*

see Frogs on page 4

Volunteers Take Action!

Watershed Restoration Projects at VLAP Lakes

Stephanie Bowser, NHVLAP Coordinator

More than once you've heard us say that "action is the key". Annual monitoring of lakes is the first and most essential step in lake protection. But some lake associations have been fortunate enough to find resources to take lake protection actions to the next level: watershed restoration.

Lake Sunapee, Sunapee

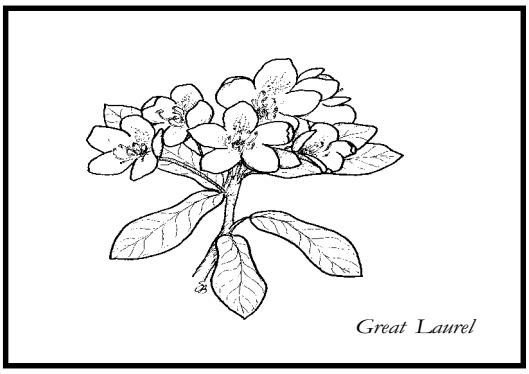
With the support of a DES Local Initiative Grant, the Lake Sunapee Protective Association (LSPA) has made great strides in watershed management. LSPA's

see Volunteers on page 6

Plantings for Your Shorefront: Options That Work for You and the Lake

Adapted from the New Hampshire Lakes Association pamphlet, "Shoreland Plantings".

New Hampshire's lakes have been pure and clear for thousands of years; a gift to us from the last ice age. They are among the most pristine and beautiful freshwater environments in the nation - they are also among the most fragile. Increased pressure from development and other land-uses have had profound effects on our lakes - greater than the natural changes over the past ten thousand years!



Great Laurel

Phosphorus pollution from fertilizers and other sources has had one of the greatest effects. Just as phosphorus makes plants grow green, it can make your lake green by feeding algae and aquatic weeds. One of the best ways to keep your lake clear and blue is to stop phosphorus from reaching the water. A critical component of protection is the narrow band of land through which water passes just before it enters a lake. When properly vegetated, these areas can filter much of the runoff from rain and snowmelt before it reaches surface waters.

You can help keep phosphorus out of New Hampshire's lakes by planting and maintaining areas of natural vegetation such as trees and shrubs in shore areas. This will help retain delicate soils and act as a filter for pollutants. Vegetation also slows the rain's flow over land, allowing runoff to seep into the ground before reaching your lake.

Beautiful Plantings -- Beautiful Lakes

Listed below are a few shrubs and plants which do well in New Hampshire's climate.

Partially Shaded Locations

Swamp Azalea - a deciduous shrub about 3' - 5' tall which grows well in sun or shade, wet or normal conditions.

Winterberry or Black Alder - a deciduous shrub free from insects and diseases - has been known to survive with the entire root system in water. 10' tall.

Sweet Pepperbush - a deciduous shrub rarely attacked by insects or disease - can withstand heavy shade or grow in full sun.

American Cranberry Bush - a deciduous shrub grows up to 10' tall - good as a screen and grows in sun or shade.

Northern Arrowwood - a durable deciduous shrub which is good for a quick-growing screen or hedge.

Inkberry - an evergreen shrub 6'-8' tall which is free from insects and diseases.

Great Laurel - an evergreen which can tolerate dense shade but needs well-drained, moist soil - a slow grower which is free from insects and diseases.

Native species require less fertilizer and less care.

Full Sun Locations

Highbush Blueberry - an excellent deciduous shrub which needs well-drained, moist soil.

Dry Soil Conditions

Blackhaw - a deciduous shrub which can tolerate dense shade or grow in the sun - a big plant, growing ~ 12'.

Ground Juniper - an evergreen groundcover for full sun, dry locations and difficult sites.

Native Groundcovers

Bunchberry - good for cool, moist woods. Grows to 9".

Barren Strawberry - good for open woods. Threatened in Maine and Massachusetts.

Virginia Creeper - a vine which tolerates virtually any conditions - good cover for walls or rock piles.

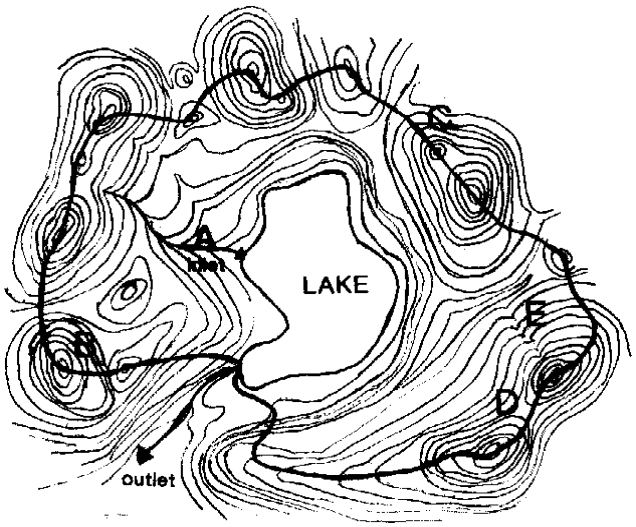
For more information on native plantings or revegetating the shoreline, please contact your local landscaper, nursery, or conservation commission, or contact the DES Shoreland Protection Program to obtain their reference, *Native and Naturalized Shoreland Plantings for New Hampshire*. For more NHLA brochures, call 226-0299☐

Limno 101: How to Draw your Watershed's Boundaries

Bob Estabrook, DES Biology Bureau Administrator

The watershed of a waterbody is all the land that drains into that waterbody, either directly or into other surface waters (ponds, streams, and wetlands) that drain into the waterbody. It is important to know the boundaries of your watershed, since any activity or development within the watershed can affect the quality of the lake you are monitoring.

All that is needed to delineate the boundary of a lake's watershed is a map showing elevation contours such as a USGS quadrangle sheet (topographic map). To draw the watershed, start at the lake's outlet, go perpendicular to the contour lines to the height of land or to a ridge that leads to the height of land; follow the height of land by connecting peaks and ridges; look at stream flow direction to see if a ridge is the watershed boundary or merely a subwatershed boundary; and continue following the height of land until completing the loop, arriving at the pond's outlet from the other side.



Some helpful hints:

1. Contour lines point upstream (A).
2. Mountain or hilltops are represented by closed loops (B).
3. Valley contour lines point toward mountain tops and are usually V-shaped (A).
Watershed boundaries never bisect a valley
4. Ridge contours point away from mountain tops and are usually U-shaped (C).
Watershed or subwatershed boundaries will bisect ridges.
5. Saddles are ridges between two mountain tops (D).
Watershed boundaries bisect saddles; the saddle also usually sits at the head of two valleys going in opposite directions.

Watershed boundaries are easiest to delineate in hilly areas with many contours. In flat areas with no streams it is less easy to determine the boundary. It is sometimes helpful to think of yourself as a raindrop: "if I landed here, which way would I roll?" □

Does Your Lake Association Want to Be on the World Wide Web?

The New Hampshire Lakes Association will create and maintain a page for you with your own text and images!

A link from the NHLA listing of lake associations
One page of text up to 5000 words with up to 5 images
Colorful images and backgrounds
Up to 4 updates each year
Links to your organization's or contact person's email address
Dependable, world-wide 24 hour access to information about your lake association including photos and events calendars and more!

Want to see more? Visit their template page at http://www.nhlakes.org/template.htm

If you do not have access to the internet or need further information, contact Michele Tremblay, Special Projects Director for NHLA, (603) 226-0299 or email at info@nhlakes.org

Frogs, continued from page 1

Stephanie: What malformities have been seen?

Hilary: In the New England area, most malformities encountered were missing or partial hind limbs, followed by shortened digits or missing feet. Nationwide they're finding malformities which include missing legs, webbing between limbs, missing digits, eyes in the wrong place, missing eye, multiple hind legs, multiple digits, ossification of skeletal structures like vertebrae and skull, and intestinal deformities.

Stephanie: Could you describe some of the theories for what's causing the malformities?

Hilary: There are three main theories surfacing as the most likely causes: parasites, ultra violet light, and xenobiotics (exotic chemicals in the environment). Parasites have proven to cause malformities. Basically, the parasites form a cyst in the limb bud area which inhibits the growth. There's evidence saying yes, that does cause malformations. However, the abundance of the malformities found cannot be attributed to the parasites. The frogs found in Minnesota were not associated with a parasite.

Stephanie: What type of parasite is it and is it found in New England?

Hilary: The parasite is a trematode. I think there's been some association made with malformities here, but the association of parasites with malformities has been pretty rare.

Ultra violet light is another possible cause. It has been studied in controlled laboratory conditions where it caused malformations in developing frogs. Exposing frogs to UV-B light for a minimum of 24 days has caused malformities. And what they are finding with UV-B light is that it's mainly causing partial limb development, down to the knee area of a frog, and deformities are symmetrical in both limbs. They have not duplicated the malformities in the field. UV-B is still suspect, especially at higher altitudes where the UV-B is very strong in the late spring or early summer when frog development is taking place. Current thinking is that there might be some synergy between the acid deposition and UV-B. Acid deposition can take some of the organics (like algae) out of the water, clarifying the lakes. What that does is

allow more light penetration in the water, which could allow greater UV-B intensity and therefore greater exposure to the organism.

Stephanie: You mentioned "exotic" chemicals as being a possible cause. What's the main type of chemical involved in malformities?

Hilary: There's potential for many, but one chemical called methoprene has demonstrated causing malformations in controlled field experiments and under laboratory conditions. Methoprene has been used as a pesticide. It's been sprayed on crops and put into cattle feed to repel flies. It was also (though not anymore) used as a constituent in indoor flea bombs.

There's more evidence leaning towards hormone mimics, chemicals that can replace or are very similar to certain types of hormones. The main one they're focusing on right now is retinoic acid, a vitamin A hormone responsible for early development in all vertebrates. The hormone is a molecule that attaches to a receptor cell and works as a key to unlock the information in the cell, telling the cell how to proceed in developing limbs, etc. What some of these hormone mimics can do is attach to the receptor, but not unlock key information, essentially "blocking" the signal that initiates development. They may also work in an agonistic manner, attaching to the cell and working just like the hormone within the body, but in excess. This may result in supernumerary development, like multiple limbs. Or it can switch that cell on and trigger the wrong kind of development. In summary, you have a very intricate system of biological circuitry within the organism that when working normally transfers information for normal development. When hormone mimics are involved, there is great potential for crossing wires and flipping switches at all the wrong places and times.

Stephanie: Where would retinoic acid mimics be coming from in the environment?

Hilary: Most likely from man-made compounds, although some are naturally occurring.

Stephanie: So they haven't specifically linked the hormone mimics to land uses like agriculture or fertilization?

Hilary: Plenty of evidence exists which demonstrates effects from hormone mimics as a result of anthropogenic activities such as industry and agriculture.

Stephanie: Why do they think frogs are being affected? Could other species be affected as well?

Hilary: Frogs live in and around water and a lot of contaminants end up in the aqueous environment. Frogs also have sensitive developmental stages in this environment. The egg masses are easily exposed to contaminants. Frogs have skin tissue which can absorb many chemicals readily,

Continued on next page

Frogs, continued from previous page

which may be why salamanders are similarly affected.

Stephanie: Can humans be affected?

Hilary: We've found out a lot in the past decade about hormone mimics and endocrine distruptors which are in the environment. We've documented decreases in sperm counts in the last 20 years or so, elevated rates of testicular and breast cancer, and there's strong evidence that they are closely linked. The malformities could be indicative of the impacts of another xenobiotic. We need to find out the implications to human health. In animals, high doses are not required to cause malformities. However, there's little documentation of how methoprene affects humans.

Stephanie: Are there hormone mimicking chemicals in household products?

Hilary: Hormone mimics are ubiquitous, found in all types of plastics, cosmetics, and chemical products, as well as naturally occurring in some plants.

Stephanie: When did they start seeing the malformities in frogs?

Hilary: Abnormalities in frogs have been documented as far back as the 1700s, but not to an extensive amount. In the past 5 or 6 years there's been a real flurry of observations.

Stephanie: Are these suspect chemicals new, or have they been around for 20 or 30 years?

Hilary: That's one of the discussions now - maybe its not xenboiotics causing malformities, since we're seeing more malformities in the past 5 or 6 years and the chemicals have been around much longer. There has been legislation passed to screen for endocrine disruptors and the like in all new products put on the market. It's a very complex issue to solve. □

Preliminary Frog Survey Results in NH

This summer the DES Biomonitoring Program, in cooperation with the U.S. Fish and Wildlife Service and the University of New Hampshire, recruited volunteers to participate in their frog survey. 30 volunteers from around the state helped DES to assess the frog populations at 25 sites. Some of the common frogs found in our wetlands and ponds included green frogs, bullfrogs, wood frogs, pickerel frogs and spring peepers. Biologists from DES and UNH together with volunteers had the not so easy task of catching frogs - a minimum, when possible, of 50 frogs at each site. Each frog was carefully examined for malformities. Healthy frogs were released, while those with suspected malformities were kept for further study.

Frogs with apparent malformities were x-rayed to look for abnormal bone structure development versus evidence of predation. They were also analyzed for abnormal levels of hormones which might result from exposure to chemical hormone mimics in their environments.

Some experts have suggested that the natural level of frog malformities in nature is 1 to 3 percent of the population. The highest incidence of malformities was found in a New Hampshire pond in Bow at a level of 9.2 percent. Eight sites had no malformities and 18 out of 25 sites had less than 5 percent malformity rates. (There is some speculation that malformed frogs are easier to catch therefore skewing our surveys; others suggest that the malformed frogs may die before we can collect them.) The endocrine studies have shown some abnormal levels of hormones in malformed frogs and evidence of abnormalities associated with the internal organs, though more study is needed.

The Biomonitoring Program has only just begun to look into the phenomenon of frog malformities. Further research will continue into the coming years.

Drawing courtesy of Jessana Palm, Biology Intern

Milfoil, Fanwort, Purple Loosestrife - Oh My!

Amy Smagula, DES Exotic Species Coordinator

With each passing season more and more waterbodies are becoming infested with exotic aquatic plants, especially the dreaded milfoil. Currently, 36 waterbodies have milfoil infestations, 5 have fanwort infestations, 1 waterbody has water chestnut (new to this state as of 1998), and thousands of acres of wetlands are infested with purple loosestrife.

In 1998 a number of efforts were made to ensure that these yearly increases of exotic infestations will come to an end. On January 1, 1998, a new statute went into effect prohibiting the sale, distribution, importation, purchase, propagation, transportation, and introduction of exotic aquatic plants in New Hampshire (RSA 487:16-a).

In addition, new rules were passed on September 5, 1998, to further define this statute. Among other things, these rules allow for the designation of restricted use areas on waterbodies, provide a listing of 14 exotic plants which are now prohibited in this state, and define appropriate means of plant disposal.

The New Hampshire Exotic Species Program is taking a proactive approach to reducing, and hopefully eliminating, new and existing infestations of exotic plants. Weed Watcher Kits, in-lake plant identification training for volunteers, informational presentations, and aquatic plant surveys are tools being used to inform the public about these nuisance plants. Signs that inform boaters about exotic plants are available at DES for posting at launch sites.We need your help to protect our lakes! An infestation prevented or at least caught in the early stages could save your lake. ***Please fill out the enclosed form and return it to:***

Amy P. Smagula,
Exotic Species Coordinator
6 Hazen Drive
Concord, NH 03301

If you have questions regarding the Exotic Species Program, think you have an infestation, or would like to become an active Weed Watcher, please contact Amy Smagula at (603)271-2248 or e-mail at a_pervanas@des.state.nh.us.

Volunteers, continued from page 1

extensive monitoring program (over 50 sites and 50 volunteers!) revealed three areas of poor water quality related to land management. A highway shed near Bucklin Beach in New London was identified as a source of salt and sand contamination. Using grant funds and significant support from the Department of Transportation (DOT), an impervious pad was created for the salt storage area, uncovered stockpiles were removed, and storm and floor drains were replaced by vegetated swales. Beck Brook, which drains the Sunapee ski area and beach, was impacted by silt and nutrient loading. Together with the Department of Resources and Economic Development, LSPA spearheaded an effort to better vegetate the ski slopes and stabilize the stream banks where Beck Brook passes through parking lots. Finally, monitoring of Eagle Rock Brook revealed significant impacts from road salting and sand. DOT agreed to switch to a sand which has less associated phosphorus and settles more quickly in roadside ditches. Roadside ditches were also enhanced with larger rocks to slow the flow of runoff, allowing greater settling of particles before the water reaches the brook. Great work, to John Taylor's Clean Stream Team and all of LSPA!

Crystal Lake, Manchester

Again using funds from a Local Initiative Grant, the Crystal Lake Preservation Association (CLPA) designed a monitoring and education plan which targeted pollution sources in this urban watershed. The monitoring revealed that stormwater runoff from roads was contributing significant pollutants to the lake. With a second grant, CLPA worked with DES and the City of Manchester to install an innovative stormwater treatment technology called StormTreat. The technology uses multichambered tanks and wetland plants to settle out and remove pollutants. The City installed the units and will maintain them over the years. This partnership and innovation is a model for lake associations everywhere.

Beaver Lake, Derry

The Beaver Lake Improvement Association (BLIA) has worked hard to improve watershed conditions in the past years. As a follow up to a federal Clean Lakes study, the association received funding to install stormwater treatment best management practices (BMPs). The projects resulted from a partnership between DES, BLIA, the Town of Derry, and the Natural Resource Conservation Service. A number of roadside swales were created to slow runoff, which allows some water to percolate into the ground and helps settle sediments. New drop culverts also help settle out sediment before water reaches the lake. And gutters around the beach concession building help channel roof runoff to prevent beach erosion. All parties have worked cooperatively to protect Beaver Lake for the future.

For information on the DES Local Initiative Grants, please contact Eric Williams at 271-3503. □

Lake Profile: Lake Wentworth in Wolfeboro

Contributed by John Nichols, Lake Wentworth Association
Edited by Stephanie Bowser, NHVLAP Coordinator

Driving northeast from the village of Wolfeboro on Route 28 there are glimpses on the right of Crescent Lake at first and then the much larger Lake Wentworth, but the road is mostly too far from the lake for a good view. By turning right on Route 109, the lake is soon visible on the right before and after passing Wentworth State Park where excellent swimming is available in the summer.

Wentworth is a beautiful lake, not over-crowded, even though the shores of the lake and its islands are well populated with 500 private camps and cottages. The water is clear and pure allowing for a Class A legislative rating. In fact, Fish and Game Department's records from 1938 show a water clarity of 5.2 meters -- 0.3 meters less than current Secchi disk readings!

The lake is about 5 square miles (3300 acres), 4 miles long and 2½ miles wide with a watershed of almost 30 square miles. The lake is blessed with several islands, including Stamp Act Island, a Nature Conservancy preserve. Lake Wentworth is fed by about 10 year-round streams, several seasonal brooks and a number of springs. The outlet consists of a navigable quarter-mile of the Smith River to Crescent Lake, which then drains over a dam down to Wolfeboro Falls, then down to Back Bay and out to Lake Winnipesaukee.

The name of the lake comes from John Wentworth, the last royal governor of New Hampshire, who had a summer home on what is now called Governor's Shore. The site of Wentworth's mansion, which burned to the ground in 1820, is now owned by the State and may be developed into a park to commemorate the history of the area.

The first camp on the lake was established in 1884. The coming of the railroad in late 1800s brought increasing populations to this up and coming resort area. Large numbers of these residents became intensely devoted to protection of the quality of life on the lake. In 1930 they formed the Lake Wentworth Association, primarily to find a way to control the water level which tended to fluctuate as the water requirements of the downstream mills varied.

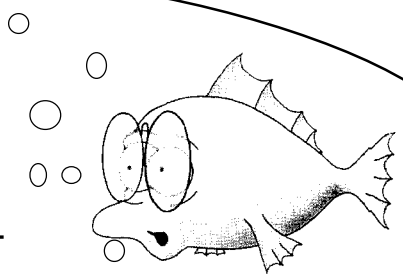
To control pollution, committees were formed to monitor water quality and educate the populace. Beginning in 1984, the University of New Hampshire's Lakes Lay Monitoring Program (LLMP) sponsored Lake Wentworth's water quality monitoring effort. The Lake Wentworth Association was extremely fortunate to have as two of its residents, geologists Richard and Lawrence Goldthwait, who worked for many years under LLMP taking weekly samples from two deep-water sites on the lake. This program was later expanded with other volunteers to three sites on Lake Wentworth and one on Crescent Lake.

When the exotic weed milfoil was found in parts of nearby Crescent Lake, drastic steps were taken to get rid of it, including harvesting, hand pulling, mats and chemical treatments, with varying degrees of success. Unfortunately, in 1998 a new exotic milfoil population was confirmed in Lake Wentworth. Complaints of increased algae growth near the shores were also becoming more frequent.

To assess lake changes and prevent further decline, DES partnered with LWA to conduct an intense 18-month diagnostic study of the lake and its watershed. Lake residents supplied much of the manpower and resources for data collection. Volunteers tested stream levels and phosphorus in all major streams every two weeks for the duration of the study so that major nutrient inputs could be pinpointed. The study has identified subwatersheds that need more attention and wiser management, as well as those affected by natural changes, such as aging ecosystems.

The history of the lake was well-documented in 1956 by Walter P. Bowman in his book *Lake Wentworth*. An update of the history was recently written by the Historical Committee of the LWA. Sets of the two volumes are available from John Nichols, 603-569-2497. □

DES is still accepting fish donations for the **State Mercury Study**!
Fish may be frozen and individually bagged.
For details, call the Biology Bureau at 271-2963.



How to Make an Integrated Sampler

Stephanie Bowser, VLAP Coordinator

Tired of hauling up that Kemmerer bottle time after time to get your chlorophyll composite sample? Make an integrated sampler and save yourself the trouble! It works like a giant straw. Just lower the weighted tube to the proper depth (to the middle layer depth if the lake has 3 layers, or to 2/3 of the total depth), crimp off the above water end, then haul up the other end with the rope or brass chain. Place the tube into a bucket and release the crimp, then -- easy! the composite water enters the bucket.

Materials: Tygon tubing/garden hose, plastic bottle or can with wide mouth, eyebolt, nut, and 2 washers, weight material (cement/sand/gravel), strong glue, small hose clamps.

Instructions:

1. Length of tube should exceed typical composite depth by 0.5 meter. Mark tube every 0.5 meter using a permanent marker and write the meter number next to the mark.
2. Put eyebolt into side of bottle at lower end using nut and washers.
3. Cut a hole the same size as the hose diameter into the cover and bottle bottom.
4. Place clamps near the bottom of the hose to keep hose shape once weight medium added.
5. Put hose through the cover and bottle. Allow hose to protrude 2 inches.
6. Apply epoxy ot seal hose and bottle.
7. Fill bottle with sand/cement and close cover.
8. Apply epoxy to hose and cover.

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